Development of the Personnel Risks Assessment and Supply Chain Strategy as a Basis of the Risk Management System of Modern Organizations

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***Abstract*— The integration of risk management technologies into the business processes of modern organizations serves as the key to highly efficient, stable and sustainable development of any business entity by considering the supply chain strategy. The sphere of management of personnel flows of organizations calls for special attention and needs an adaptive, flexible and integrated risk management system able to ensure both the timely achievement of strategic goals and a high level of personnel security of organizations. The objective of the study is to analyze existing personnel risks and develop an adaptive, universal methodology for assessing their likelihood, with further modeling of possible risk scenarios. In the framework of the study, a two-stage method for estimating the probability of occurrence of 30 personnel risks characteristic of different types of personnel flows was tested. Possible scenarios were simulated using the Scenario Manager method. Modern Russian trade organizations seeking to build an effective personnel security management system can use the methodical approach proposed by the authors in their risk management system.**

***Keywords*—** *risk management, personnel security, personnel potential, supply chain management, personnel flows, personnel risk, assessment and modeling of personnel risks.*

1. Introduction

The lack of an adaptive, comprehensive and effective personnel risk management system can cause multiple adverse consequences, including low economic and personnel security, motivational imbalances, reduced profitability of organizations, etc. Thus, the primary strategic challenge facing the heads of modern organizations should be a minimization of the threats present in various business processes directly caused by the occurrence of some personnel risk. A wide variety and high probability of personnel risks are one of the consequences of insufficient attention of the management of modern organizations to this problem [1-6]. It should be noted that the personnel-associated risks account for 65% to 80% of all possible adverse events that threaten a business [7-10].

Given the results of analytical studies and the international rating provided by the audit and consulting company - Ernst & Young, personnel risks are among the most significant and potentially dangerous for organizations of any form of ownership [11, 12]. According to 2013, personnel risks ranked fifth in a dozen of risks requiring more attention of management. Recently, the probability of personnel risks has been growing permanently. One of such personnel risks was a catastrophic shortage of skilled labor: at the beginning of 2018 this risk ranked fifteenth, while at the end of 2018 it already occupied the 10th position [13].

Creating an effective risk management system today is one of the key factors that determine the priority and importance of numerous studies and authoring in the plane of effective management of personnel flows, however, researchers have not yet developed an adaptive and universal methodology [14-20].

The above circumstances actualize the need for a detailed analysis of existing personnel risks, as well as the development of an adaptive and universal methodology for assessing the likelihood of their occurrence, followed by modeling of potential risk scenarios as an element of the system of personnel risk management ensuring an increase in personnel security of modern organizations.

2. Materials and Methods

The analytical base of the author's research was the data of financial and statistical reporting of a total of 16 organizations of the trade industry of Belgorod region, quantitative and qualitative indicators of the personnel potential of the studied

organizations. Research methods: monographic, structural and comparative analysis, socio-economic planning and forecasting, questioning, semi-formalized in-person-correspondence expert interview, and in-depth focus-group interview.

3. Results and Discussion

The risk spectrum of modern HR management is quite diverse, which is caused not only by the uncertainty and dynamism of the environment the organizations operate in, but also by the wide range of reasons for the emergence of each individual personnel risk, which can be combined into two groups: a group of external factors (divided into the direct and indirect influence factors) and a group of internal factors [21, 22].

At the initial stage of the study of the stated problem, special attention was paid to the nomenclature of personnel risks, which should consider the management features of each individual type of organization's personnel flows: incoming, internal, and outgoing personnel flows. For this purpose, the experts compiled a list of 30 most important and frequently encountered personnel risks. The experts in the course of assessing the probability of occurrence of personnel risks were the heads of the studied trade organizations, as well as the heads of personnel management services.

Subject to the specifics of the study, it is advisable to define the concept of "personnel flow", which is traditionally understood as the totality of all labor resources that perform logistic operations within the logistic system and provide communication (material, financial, informational) between the system itself and the environment [23]. In our opinion, this definition of a personnel flow should be supplemented with a characteristic feature that consists in the dynamic nature of personnel flows, leading to the formation of an entire system of permanent movement both inside and outside the logistics system, which forms the surrounding personnel of the enterprise.

As a result of using hierarchical cluster analysis, the organizations under study were differentiated into three separate clusters according to indicators of their human potential [24-28]. The clustering was carried out subject to the indicators characterizing both the qualitative and quantitative components of human resources, including: net profit per employee, staff turnover rate, labor productivity, wage rate, proportion of employees with higher, secondary and secondary vocational education in total, the monthly wage fund, as well as the average number of employees. The estimated period for these indicators was 2018.

The entire course of the study can be represented in two key stages:

1. Evaluation of the probability of personnel risks by expert assessments with their subsequent distribution by probability zones - the minimum, weak, medium, high, maximum, and critical zone.

2. Modeling of personnel risks using Scenario Manager.

Modern technologies of personnel risk management make it possible to estimate the likelihood of some personnel risk typical of certain types of personnel flows. To do this assessment, a statistical analysis method, a sensitivity analysis method (critical values), a normative method, an analogy method, a decision tree, a Monte Carlo method, simulation modeling or a rating method can be used, but in acute information deficit one of the best methods is expert assessments [21]. The above method was practically implemented in several steps, namely:

– ranking of personnel risks - involves the determination of evaluation criteria and their subsequent ranking within the framework of a specific current personnel situation;

– weighing - determination of the weight characteristics of each evaluation criterion;

– a comprehensive assessment of the probability of personnel risks.

At the beginning of the first stage of the study of the probability of the selected 30 personnel risks, 20 experts were involved who assessed the degree of "probability" on a 0-to-1 scale (Table 1).

Table 1. Personnel risks probability scale

Expert value	Degree of the personnel risks probability
0.0 – 0.1	Minimum probability
0.2 – 0.3	Low probability
0.4 – 0.5	Moderate probability
0.6 – 0.7	High probability
0.8 – 1.0	Critical probability

Based on the scale presented in Table 1, the probability of each individual personnel risk as well as an assessment of the degree of probability of individual personnel risks in the percentage value was calculated using the following formula [19]:

$$V_i = \frac{\sum_i}{\sum max} * 100\% \quad (1),$$

where:

V_i is the probability of the i-th personnel risk in %;

Σ_i is the sum of expert assessments for the i-th personnel risk (point);

Σ_{max} is the maximum possible amount of expert assessments (points).

The calculations made in the context of the three selected clusters are presented in Table 2.

Table 2. The results of expert assessment of the probability of personnel risks in the management system of personnel flows of the studied organizations

Personnel risk in the context of certain types of personnel flows	Σ of the resulting values of the probability of risk according to the expert assessment			Probability of personnel risk, %		
	Cluster I	Cluster II	Cluster III	Cluster I	Cluster II	Cluster III
Personnel risks of incoming personnel flows						
1. Unbalanced labor demand and supply in the regional and local labor market	3.7	6.0	7.0	37	60	70
2. Mismatch of methods of recruitment and the general business strategy of an enterprise	2.5	3.6	6.4	25	36	64
3. Imperfect labor legislation of the country	4.3	8.2	6.1	43	82	61
4. Non-compliance of the chosen candidate with the requirements of the vacancy	4.0	7.5	4.5	40	75	45
5. The lack of clear requirements for future candidates for the vacancy	4.2	6.9	3.8	42	69	38
6. Imperfect system of personnel search and selection	3.9	4.4	4.4	39	44	44

Personnel risks of internal personnel flows						
7. Imperfect system of motivation and stimulation of internal personnel flows	3.5	4.5	4.9	35	45	49
8. mismatch of the logistics and personnel strategy and the general corporate strategy of the enterprise	3.6	3.2	5.4	36	32	54
9. Inefficient human resource management system	4.1	4.7	5.2	41	47	52
10. Unfavorable moral and psychological climate	4.8	6.6	3.3	48	66	33
11. Lack of conflict management system	5.1	5.1	7.7	51	51	77
12. Imperfect promotion and career growth system	3.2	7.1	6.0	32	71	60
13. The subjective nature of the methods of evaluation and assessment of internal personnel flows	3.4	5.8	5.6	34	58	56
14. Imperfect and weak domestic education system	2.9	3.2	7.9	29	32	49
15. Unfavorable and poor labor conditions	2.7	5.4	7.6	27	54	76
16. Risks of leakage of important commercial information of the enterprise	3.0	2.9	5.2	30	29	52
17. The risk of a negative personnel image of the enterprise	4.3	3.8	7.3	43	38	73
18. Psychophysiological risks	5.2	3.2	7.8	52	32	78
19. Moral and psychological risks	4.3	6.2	7.1	43	62	71
20. Irrational timing of labor hours	3.8	5.3	6.9	38	53	69
21. Violations of the labor legislation of the Russian Federation	2.7	7.5	6.9	27	75	69
22. Violations of the Criminal Code of the Russian Federation	2.6	3.6	4.5	26	36	45
23. High employee turnover rates	3.2	7.0	7.5	32	70	75
24. Decrease in labor productivity	3.3	3.7	4.9	33	37	79
25. Low level of social protection of						

staff	3.9	5.1	3.1	39	51	31
26. Lack of innovative human resource management	5.1	5.3	7.2	51	53	72
Personnel risks of outgoing personnel flows						
27. Failure to comply with labor laws when dismissing personnel	3.7	4.8	6.8	37	48	68
28. Risk of losing valuable, highly qualified personnel	4.4	4.1	5.4	44	41	54
29. Imperfect system of personnel release	4.1	3.6	5.5	41	36	55
30. Dismissal due to information or material damage to the enterprise	3.5	2.8	4.7	35	28	47
Σ (max=300)	113.0	151.1	176.6			
The average of the occurrence of personnel risks, %	-	-	-	35.5	50.4	58.9

The obtained data in Table 2 allow us to visualize the results of assessing the probability of personnel risks within the framework of individual clusters for research (Fig. 1). The distribution process in 6 zones reflecting certain levels of probability of personnel risks was made on the basis that the maximum possible sum of points potentially related to each type of personnel risk may be equal to 300 points. In accordance with this, the critical area of occurrence of personnel risks will correspond to the range from 201 to 300 points, the maximum probability zone - 161-200 points, the high probability zone - 111-160 points, the moderate probability zone - 81-110 points, the low probability zone - 51-80 points, and the minimum probability zone - from 0 to 50 points.

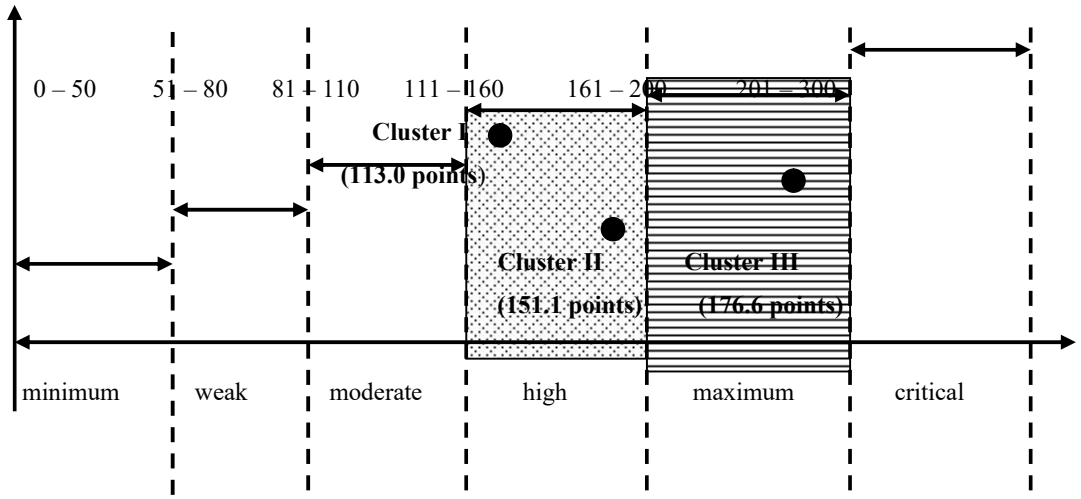


Fig. 1. Probability zones of occurrence of personnel risks in the system of personnel flows of various organizations among the three clusters

Thus, Figure 1 clearly shows that organizations of clusters I and II fell into the zone with a high probability of personnel risks, while organizations of cluster III were in the zone with the maximum probability of risks. Taking into account the results obtained, we should pay special attention to those types of personnel risks that differ in the maximum values of their probability (Table 2.)

Based on data in Table 2, the trends may be summarized as follows:

– in terms of the group of organizations in the first cluster, the highest probability of occurrence of personnel risks of incoming personnel flows is characteristic of the risks of imperfect labor legislation of the country (43%), the risk of lack of clear requirements for candidates for a vacancy (42%) and the risk of non-compliance of the selected candidate with the requirements of a vacancy (40%). For internal personnel flows, psychophysiological risks are most likely (52%), the risk of lack of a conflict management system (51%) and risks associated with the lack of innovative methods of personnel flows management (51%). For the outgoing personnel flows, the greatest threat is the risk of losing valuable, highly qualified personnel (44%) and the risk associated with an imperfect personnel release system (41%);

– in terms of organizations in the second cluster, the critical values are noted for the risk of imperfection of the domestic labor legislation (82%), the risk of the candidate's non-compliance with the requirements of a vacancy (75%) and the risk of lack of clear requirements for candidates for a vacancy (69 %). For internal personnel flows, a separate threat is the risk of violation of labor laws (75%), the risk of imperfect promotion and career growth systems (71%) and the risk of high staff turnover (70%). The highest probability of personnel risks for outgoing personnel flows of organizations of cluster II is characteristic of the risk of non-compliance with labor legislation of the Russian Federation upon dismissal of personnel (48%) and the risk of loss of valuable, highly qualified personnel (41%);

– incoming personnel flows of organizations of cluster III are characterized by the highest probability of personnel risks occurring as a result of unbalanced labor demand and supply in the labor market (70%), inconsistencies in the recruitment methods of business strategy (64%) and inadequate labor legislation (61%). For internal personnel flows, the risk of decline in labor productivity is most likely (79%), as well as the risks associated with the lack of a conflict management system (77%). Outgoing personnel flows of organizations of cluster III are subject to the most negative impact of personnel risks from non-compliance with labor laws in case of personnel dismissal (68%) and the imperfect system of personnel release (55%).

The second stage of the study, which consists in modeling of personnel risks, is aimed at providing greater detail in the likelihood of personnel risks appearing in the personnel flow management system of the trade organizations under study. As part of the study, the Scenario Manager method [19] was used, and the basis for the modeling was a model created by the authors, presented as a formula (Formula 2):

$$I_{ij} = \sum_{1}^{17}\left(IK_{ij} * W_{ij}\right) + \sum_{1}^{5}\left(CQI_{ij} * W_{ij}\right) + \sum_{1}^{3}\left(CSPI_{ij} * W_{ij}\right) \quad (2),$$

where:

I ij is an integral indicator of the efficiency of the personnel potential of the organization under study;

IK ij is a comprehensive indicator of the quantitative characteristics of the economic component of the personnel potential (includes 17 particular indicators, such as staff movement factors (staff turnover rate, consistency factor, staff stability index, turnover rate at reception and turnover rate at retirement), utilization rates of the fund working time (the calendar worktime fund utilization rate, the worktime fund utilization rate, the maximum possible worktime fund utilization rate), profit index per employee, profit index per trade-operative employee, profit per ruble payroll fund, average labor productivity of one employee, average labor productivity of one trade-operational employee, labor intensity, the share of employees with higher education in the total number of personnel, the share of employees with secondary vocational education in the total number of personnel, the share of employees with secondary education in total number of personnel) [15; 18];

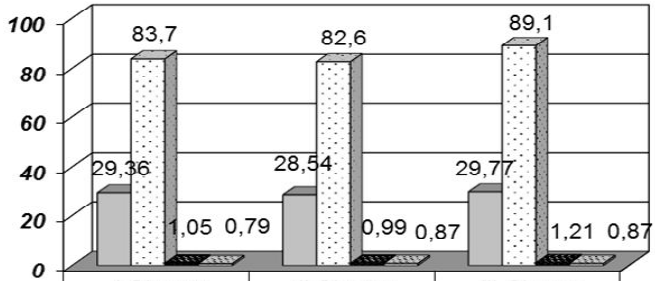
CQI ij is a comprehensive indicator of the state of qualitative characteristics of the economic component of human potential (calculated on the basis of 5 indicators, including the indicator of the type of nervous system, an indicator of the level of intellectual lability, an indicator of the level of intellectual development, an indicator of the level of business activity and an indicator of neuro-psychological stability);

CSPI ij is a comprehensive indicator of the level of social protection of employees (calculated on the basis of 4 indicators - advanced training rate, the level of implementation of measures to improve and upgrade working conditions, the level of implementation of social protection measures);

W ij is the significance of each individual indicator.

The parameters of the constituent elements of the formula 2 were set in accordance with three possible scenarios: optimistic, realistic and pessimistic. The significance of the comprehensive indicator of the quantitative characteristics of the economic component of the personnel potential was 0.33; the significance of the comprehensive indicator of the state of the qualitative characteristics of the economic component of the personnel potential was 0.34; the significance of a comprehensive indicator of the level of social protection was 0.33.

To simulate personnel risks using Scenario Manager, the basic information was the calculation of the integral indicator of the efficiency of using the personnel potential of the studied organizations as well as the indicators reflected in formula 2. The values of these indicators are presented in Figure 2.



	I Cluster	II Cluster	III Cluster
I ij	29,36	28,54	29,77
IK ij	83,7	82,6	89,1
CQI ij	1,05	0,99	1,21
CSPI ij	0,79	0,87	0,87

Fig. 2. The indicators of efficiency of use of personnel potential which became initial information for modeling of personnel risks

The results of the modeling of the probability of personnel risks for incoming, internal and outgoing personnel flows show that the pessimistic scenario poses the maximum threat to the personnel potential of the studied organizations. This type of scenario in the context of the organizations of cluster I carries the potential threat of reducing the integral indicator of the efficiency of human capacity up to 13.96 compared to the value of 2018 - 29.36. For trade organizations of cluster II, the expected decrease in the above indicator may be up to 13.78 compared with the value of 2018, which amounted to 28.54. The integral indicator of the efficiency of the personnel potential of the organizations of cluster III may decrease by 14.75 and reach 15.02.

Thus, the calculations carried out as part of the study of the probability of personnel risks for different types of personnel flows indicate the sharp need to develop or improve the current system of personnel risk management, subject to

the above-mentioned potential threats and hazards posed by certain types of personnel risks.

4. Summar

The two-stage methodology developed by the authors for assessing and modeling the probability of personnel risks in the personnel management system of trade organizations will allow solving simultaneously several key strategic tasks, which can also be described as certain advantages of the presented methodology:

1. The possibility of efficient processing of incomplete and fuzzy source data in the information deficit of statistics and data of other categories.

2. The possibility of identifying and structuring the objective and subjective personnel risks in accordance with the types of personnel flows.

3. The possibility of quantitative assessment of the probability of personnel risks in the management system of personnel flows of the studied organizations.

4. Acquisition of the information necessary for the purposeful development of projects (activities) to minimize the negative impact of personnel risks on the personnel potential of organizations based on their future foresight assessment.

The probability of personnel risks cannot be completely eliminated, but the integration of individual technologies of modern risk management and the methods developed by the authors allow maximally level them off, foresee and prevent some negative consequences, and make appropriate adjustments to the current strategy for managing the personnel potential of modern trading organizations.

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